

The Influence of Virtual Geometry Technology on Animation Industry

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Abstract: The emergence of virtual geometry technology has changed the cost and way of animation production, which has promoted the improvement of animation level and the output of high-quality animation, reduced the threshold of animation production, and enabled more people to transfer cultural connotation through such forms of expression of animation.

Keywords: Virtual geometry technology; GPU

Virtual geometry technology is based on geometric graphics theory to parameterize 3D models or surfaces and map them to plane rectangular areas to minimize distortion. We then resampled the plane and recorded the geometric position and normal vector information at the corresponding pixels of the image. The geometric image contains all the geometric information of the 3D surface, so the result of real-time rendering is the high-definition 3D model we see.

1. Why do we need virtual geometry

1.1 Animation market generally pursues high image quality

The level of picture quality for the overall impact of an animation is very high. The nature of animation film itself determines that the requirements for image quality are always very high. Many animation or animated movies use 4K image quality, so that the audience can feel the details of the work when watching. And the high-definition image quality can immerse the audience. In order to restore the real animation scene and character status and details in the market, and to improve the audience's viewing quality, the production of animation film becomes more difficult.

1.2 More realistic resilience

If the script is the soul of animation, then the picture production is the flesh and blood, which can let the audience have a more real experience of the charm of animation. Due to the differences in cultural background, European animation is realistic, while Chinese animation screen is more aesthetic. For example, the recently popular "Mainland of DouLuo", from the perspective of animation, the picture is realistic and illusory, and the content is highly reductive to the original work.

1.3 The modeling of characters and scenes is more three-dimensional and vivid

In addition to the character and scene design, the modeling of the whole film is also very important to the success or failure of a 3D animation. In Mainland of DouLuo, the modeling of the leading role was targeted independently at different ages and periods, and detailed characterization of character characteristics in different periods. In the film, the importance of female characters is distinguished by the length of their hair. As the heroine, Xiao Wu finally modified her role in line with the audience's aesthetic taste through many times of modified modeling, which made the film more popular. Thus it can be seen that the quality of the modeling can determine the quality of the film.

2. The current problems

2.1 Production technical problems

The method currently in use on the market is LOD technology

LOD technology is short for Levels of Detail, meaning multiple Levels of Detail. LOD technology refers to the allocation of effective rendering resources according to the distance and importance of objects in the picture, and the reduction of the face number of out-of-picture or distant object model, so as to allocate more rendering resources to close-up or close-up objects to improve the rendering speed.

Advantages: Model precision is controllable;

Disadvantages: the material resources are large, the model needs a large number of personnel to make, each level of the model needs to be optimized by a separate number;

There are many versions of LOD technology, such as Mesh Decimation, Vertex Clustering, Vertex Merge and so on.

2.2 Hardware problems

1) CPU bandwidth problem

Most current home computers have CPUs that can compute between 1 GFLOPS and 50 GFLOPS per second, which is more than enough for pure computing power. The current vertex shading method used in 3D model rendering is that the CPU calculates at least 3-4 floating points per vertex, which is 12-16 bytes, so 100 million vertices is 1.2-1.6 billion, which is about 1GB. The actual bandwidth of today's desktop GPUs is usually in the hundreds of Gb/s, which means it takes a few seconds for 1GB of data to travel from the CPU to the graphics card, which is not a short amount of time, but is acceptable for 30fps. The problem is that the vertex data needs to be passed from the CPU to the GPU for rendering, because the animation is done by the CPU, and the CPU bandwidth is usually only a few gigabytes to a dozen gigabytes. The bandwidth at this point is obviously not enough to handle such a large amount of data exchange, and the CPU graphics memory is also limited to buffer all the rendering results from the CPU, which is the main contradiction.

2) Bandwidth of external storage to video memory

After the direct comparison between CPU and GPU, the model is rasterized by hardware. Before rasterization, operations such as cone clipping, back elimination, and zero area elimination are performed.

3) Effective GPU computing power

The working principle of GPU is that no matter how small the triangle is, as long as there is no Cull drop, four useless pixels will be generated. For the model triangle surface with tens of millions or hundreds of millions of times, tens of billions of useless fragments are likely to be generated, and these data will block the second half of the GPU rendering pipeline and delay the rendering time.

3. Virtual geometry technology brings those benefits to the future animation industry

(1) Save manpower and time costs, improve work efficiency

As mentioned above, current 3D modeling techniques use LOD, which requires modelers to prepare different precision versions of a 3D model:

High-precision level of 3D models; (High Poly).

Low level of accuracy of 3D models; (Low Poly).

After baking the high model - correcting the errors in the model - then baking the high model again to get the final map containing the information (normal, color, bump, texture, lighting, etc.), then pasting the baked image back to the low model to preserve as much detail as possible in the high model. This added a lot of manpower and extended the animation production time.

At present, although animation modeling also uses high models, the faces of the models still can not show many details, otherwise the rendering time will multiply. If we use the rendering farm, according to the lowest price on the market, rendering a film at TV level animation of 20 minutes or so also needs about 100,000 RMB, which increases the production cost.

Virtual polygon technology allows geometry to overcome the limitation of the number of faces, even if the number of faces of a single model is in the millions, it can be easily rendered. so that designers can say no to the trivial work, and focus on other important work such as script.

(2) Improve the fineness of the picture

Virtual geometry technology allows us to directly use ZBrush, Mudbox and other sculpting software to produce high-precision 3D models, direct use, and retain all the details of the high model, the technology can not only support the high model but also use 8K map to enhance the texture of the model.

(3) Lower the barrier to animation production

As we all know, the most time-consuming part of animation is modeling and rendering, but with virtual geometry technology, we don't have to worry about the model. There are various types of characters in DAZ software, and they are all high models. Most of them are free to use, even if the price is between tens and hundreds RMB. In terms of scenes, MegaScan provides a very rich set of high-precision 3D scanning models. The remaining character expressions and actions can be purchased from the expression library and action library, which greatly reduces the production cost of the film and shortens the production time of the whole process. Even a team of several people can complete a work. Animation films are no longer exclusive to large companies. Using this technology, as long as the script and story are good, the audience can be recognized.

In the future, as virtual geometry technology gradually matures and is used by many software and hardware developers (such as Autodesk, AMD, NVI, etc.), we need not to consider the number of model faces at that time, we will be able to make animation into a large piece of the visual effect, beautiful picture, natural soft light, sound impact, that can let the user enjoy the visual feast more naturally.

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